E7.3 10292
CR-130575

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. 3	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle: Break-up Characteristics of Chena River Basin		5. Report Date: February 20, 1973 6. Performing Organization Code
7. Author(s): Robert F. Carlson		8. Performing Organization Report No.
9. Performing Organization Name and Address: Institute of Water Resources, University of Alaska, Fairbanks, Alaska 99701		10. Work Unit No. 11. Contract or Grant No. NAS5-21833
12. Sponsoring Agency Name and Address: National Aeronautics & Space Administration, Goddard Space Flight Center, Greenbelt, Maryland 20771, Technical Monitor: Mr. Edward C. Crump, Code 430		13. Type of Report and Period Covered: Type II, July 1972 - January 1973 14. Sponsoring Agency Code

15. Supplementary Notes

ERTS-1 Project No. 110-5
Robert F. Carlson / UN 596

16. Abstract

Flooding throughout Alaska is one of the major water resource problems faced by the state. Forecasting of these floods is based on a sparse network of hydrologic data collection station. The objective of this study is to evaluate the utility of satellite imagery as a spring break-up forecasting tool for the Chena River Basin near Fairbanks, Alaska.

The launching of the ERTS-1 satellite followed the 1972 spring break-up. The imagery received during the fall snow accumulation period is being used to: 1) examine the ability to map areal and elevational distribution of snow cover; 2) acquaint the investigators with the various remote sensing hardware purchased under ERTS project 110-1; 3) evaluate other hydrologic applications of ERTS imagery; and 4) enhance the imagery using various photographic techniques.

Images of 25 September 72 (1064-20325-M) and of 13 October 72 (1082-20331-M) showed partial snow cover at higher elevations in the Chena River Basin. Depiction of snow cover during the period of accumulation can be easily made. No opportunities developed in which snow ablation could be studied.

17. Key Words (Selected by Author(s))	18. Distribution Statement
ERTS IMAGERY SNOW DISTRIBUTION HYDROLOGY	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	12	$3.00

(E73-10292) BREAK-UP CHARACTERISTICS OF CHENA RIVER BASIN Progress Report, Jul. 1972 - Jan. 1973 (Alaska Univ., Fairbanks.) 12 p HC $3.00 CSCL 08H

N73-17497

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I. INTRODUCTION

This summary report describes the progress made in the first 6 months of Contract no. NAS5-21833, ERTS-1 project no. 110-5, Break-up Characteristics of Chena River Basin.

Since the major aim of this study is to look at snow ablation and since no periods of ablation occurred during the first six months, there is very few results to report. Five sets of imagery were received from 20 August 72 to 5 November 72 of the Chena River Basin. Two sets of imagery during the month of September have substantial amounts of cloud cover. All of the images received to date have been filed according to area of coverage. Images (1064-20325-M, 25 September 72; 1082-20331-M, 13 October 72; and 1103-20502-M, 3 November 72) will be used to acquaint ourselves on the capabilities of the Color Display Unit (CDU) and the Color Additive Viewer (CAV). Also, various photographic enlargement techniques are being used on these same images. The areal distribution of snow cover during the period of accumulation was readily made.

II. STATUS OF PROJECT

A. OBJECTIVES

The overall main objective of this project is to examine the utility of satellite imagery as a flood forecasting tool during spring break-up. Since we have observed no ablation periods since the initial imagery was obtained, the immediate goals have been to acquaint ourselves with the capabilities of the basic data and available analysis techniques. Spring break-up on the Chena River generally occurs in the month of April, May and June.

B. ACCOMPLISHMENTS DURING THE REPORTING PERIOD

1. Preliminary Investigations

Initially we examined the imagery to determine what capabilities existed. As the imagery was received, it was visually analyzed and filed according to area of coverage. Summary sheets were compiled on each set of images indicating date, major drainages, cloud cover conditions, hydrologic features, and the MSS bands available. The ability to determine area-elevation distribution of snow was examined. Images of 25 September 1972 (1064-20325-M) and of 13 October 1972 (1082-20331-M) were used to delineate areas of snow coverage at higher elevations in the Chena River Basin. It is felt that there should be no difficulty in mapping snow cover during periods of ablation. Presently we are constructing a mosaic of our study area from the following images: 1030-20442-6, 22 August 1972; 1030-20435-6, 22 August 1972; 1029-20383-6, 21 August 1972; and 1029-20381-6, 21 August 1972. This mosaic is being enlarged by a factor of 4 with a scale of 1:250,000, the same scale as U. S. Geological Survey Topographic maps. Projection of transparencies obtained during periods of ablation can be projected directly on this mosaic or the topographic map.

2. Applicability of ERTS-1 data to project objectives

As mentioned previously, we have not been able to utilize ERTS imagery during periods of snow ablation. Our immediate aim has been to gear up for the forthcoming break-up this spring. It was demonstrated that during periods of snow accumulation, the distribution, both areal and elevational, could be determined.

Two sets of images showed partial snow cover in the basin on 25 September 1972 and 13 October 1972. The last set of images on 3 November 1972 showed that the entire basin was covered with snow. Although images showing complete snow cover are of little value in this project, it was noted of the November images that the quality was excellent, even with the low sun angle and resulting shadows. It would appear that data collection should be continuous through November, December, and January if of value to other projects.

3. Results

It was demonstrated that areal snow coverage could be mapped from ERTS imagery. No periods of snow ablation have occurred to evaluate the other project objectives. While preliminary examinations of the ERTS imagery was made, other hydrologic applications were investigated. It was apparent that ERTS imagery could be used to inventory surface water resources. Lakes as small as 200 feet in diameter were detected in the vicinity of Minto Lakes area (1033-21011-M, 25 August 1972). The Tanana River which flows through this complex of lakes appears quite light in band 5, almost undetectable in band 6, and quite dark in band 7. The lakes are visible as dark areas with band 6 being the darkest. The significance of these data is that potential surface storage could be measured for watersheds that have a substantial number of lakes. This potential storage would be available to both spring runoff and summer precipitation. One should be cautious, because certain cloud types cast shadows that are similar to the lake appearance. The difference in the imagery for a lake and a river of the same band is due to the amount of suspended sediment found

in the rivers. The Tanana River has a very heavy sediment load.

III. NEW TECHNOLOGY

None

IV. PLANS FOR NEXT REPORTING PERIOD

Since the satellite coverage of Alaska was discontinued from 15 November 1972 to 15 February 1973, we will not receive any additional imagery during February and March of 1973. When the CDU hardware is installed, we will make use of the fall images to acquaint ourselves with the capabilities of this unit. As of 1 February 1973, we have started collecting ground truth data on snow cover, snow density, runoff, and other environmental parameters that actually contribute to snow ablation.

During the next six months, ablation of the snowpack will occur. Then we will be able to evaluate the utility of ERTS imagery as a flood forecasting tool. The objectives as outlined in the original proposal will be pursued.

V. CONCLUSIONS

In line with the primary objectives of this project, we were able to map in detail areas of snow coverage during the period of accumulation in the Chena River Basin. Outside our goals, we did indicate the potential for determining possible surface storage in watersheds with a substantial number of lakes.

VI. RECOMMENDATIONS

None

VII. PUBLICATIONS

None

VIII. REFERENCES

None

Appendix A - Change In Standing Order Forms

None

Appendix B - ERTS Data Request Forms

None

APPENDIX C - ERTS IMAGE DESCRIPTOR FORMS

ERTS IMAGE DESCRIPTOR FORM

(See Instructions on Back)

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ID

DATE 31 January 1973

PRINCIPAL INVESTIGATOR Robert F. Carlson

GSFC UN 596

ORGANIZATION Institute of Water Resources, University of Alaska

PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
	Snow	Lake	River	
1028-20324-M			✓	
1029-20381-M			✓	
1029-20383-M	✓		✓	Glaciers
1030-20435-4		✓	✓	
1030-20435-5		✓	✓	
1030-20435-6		✓	✓	
1030-20442-4	✓	✓	✓	
1030-20442-5	✓	✓	✓	
1030-20442-6	✓	✓	✓	Glaciers
1033-21011-5			✓	
1033-21011-6			✓	
1033-21011-7			✓	
1046-20325-M			✓	
1048-20435-M			✓	
1050-20552-M		✓	✓	
1050-20555-M	✓	✓	✓	
1064-20325-M	✓	✓	✓	
1066-20435-M				
1066-20442-M	✓		✓	Glaciers
1069-21010-M			✓	
1082-20331-M	✓		✓	
1100-20333-M	✓			
1102-20450-M	✓			
1102-20443-M	✓			

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

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ERTS IMAGE DESCRIPTOR FORM

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DATE 31 January 1973

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ORGANIZATION Institute of Water Resources, University of Alaska

PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
	Snow	Lake	River	
1103-20502-M	✓	✓	✓	
1103-20504-M	✓		✓	
1104-20563-M	✓		✓	
1104-20560-M	✓		✓	
1105-21015-M	✓		✓	

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APPENDIX D - SIGNIFICANT RESULTS

SIX-MONTHS PROGRESS REPORT
UNIVERSITY OF ALASKA

ERTS PROJECT 110-5
February 15,1973

PRINCIPAL INVESTIGATOR: Robert F. Carlson

TITLE OF INVESTIGATION: Break-up Characteristics of Chena River Basin

DISCIPLINE: Hydrology

SUMMARY OF SIGNIFICANT RESULTS:

While visually analyzing ERTS data for August and September,1972, it was found that lakes as small as 200 feet in diameter were visible on the imagery. An examination of the imagery for the Minto Lakes Area (1033-21011-M, 25 August 1972) shows that the lakes take on their darkest appearance in band 6-MSS. The Tanana River which flows through this area appears quite light in band 5, quite dark in band 7, and is almost undetectable for band 6. The significance of these data are that potential surface storage could be measured for watersheds that have substantial numbers of lakes. This potential storage would be available to both spring runoff and summer precipitation. One should be cautious because certain clouds cast a shadow that is similar to the lake appearance. The difference of the imagery for a lake and a river of the same band is due to the sediment load of the river. The Tanana River had a heavy glacial sediment load.

In line with the primary objectives of this project, the area of snow cover during the fall accumulation could be mapped in detail. Images 1064-20325 (25 September 1972) and 1082-20331 (13 October 1972) illustrate the partial snow cover in the upper Chena River Basin.